

In the event of any doubt or misunderstanding arising from this translation, the standard in Thai will be held to be authoritative.

Unofficial Translation  
**TIS 2062-2543 (2000)**  
**Thai Industrial Standard**  
**for**  
**Electrical thermopots: Safety requirement**

### 1.Scope

- 1.1 This standard specifies classification, requirement, marking and labelling, sampling and criteria for conformity and test for electrical thermopots for household and similar purposes, the rated voltage being not more than 250 V for single-phase a.c. supply and having water capacity not exceeding 10 litres.
- 1.2 This standard deals with the safety requirement for electrical thermopots.
- 1.3 This standard does not cover electrical thermopots designed for used in special locations, such as to be used in vehicles or on board ships or aircraft, or used in locations with special conditions, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas) or used in locations where young children or infirm persons without supervision, additional requirements may be necessary.

### 2. Definition

The meaning of terminology in this standard shall be in accordance with TIS 1375 Part 1, and the followings:

- 2.1 Electrical thermopots: Electrical appliances which can be changed electrical energy to heating energy intended to automatically boiling and can be remained the temperature as well.
- 2.2 Normal operation : Electrical thermopots are operated by filled with water equal to the capacity of the container then close the tap.
- 2.3 Limited capacity : Capacity assigned to the electrical thermopots by the manufacturer.
- 2.4 Class OI electrical thermopots: Electrical thermopots having at least basic insulation throughout and provided with and earthing thermal but with a supply cord without earthing conductor and a plug without earthing contact.

2.5 Class I electrical thermopots: electrical thermopots in which protection against electric shock does not rely on basic insulation only but which includes an additional safety precaution in that conductive accessible parts are connected to the protective earthing conductor in the fixed wiring of the installation in such a way that conductive accessible parts cannot become live in the event of a failure of the basic insulation.

*Note: This measure includes the protective earthing conductor for safety in supply cord.*

2.6 Class II electrical thermopots: Electrical thermopots in which protection against electric shocks does not rely on basic insulation only but which includes an additional safety precaution, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

*Notes: 1. Class II electrical thermopots may be of one of the following types:*

*a) an appliance having a durable and substantially continuous enclosure of insulating material which envelops all metal parts. With the exception of small parts, such as nameplates, screws, and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; such an appliance is called an insulation-encased Class II appliances;*

*b) an appliance having a substantially continuous metal enclosure, in which double insulation or reinforced insulation is used throughout, such as an appliance is called a metal-encased Class II appliance;*

*c) an appliance which is a combination of types a) and b);*

*2. The enclosure of an insulation-encased Class II appliance may from a part of the whole of the supplementary insulation or of the reinforced insulation.*

*3. If an appliance with double insulation or reinforced insulation throughout has provision for earthing, it is considered to be a Class I of a Class OI appliance.*

*4. Class II appliances may be provided with means for maintaining the continuity of protective circuits, provided that such means are within the appliance and are insulated from conductive accessible parts by supplementary insulation.*

### 3. Classification

- 3.1 Electrical thermopots shall be classified, with respect to protection against electric shock, into 3 classes.
  - 3.1.1 Class OI
  - 3.1.2 Class I
  - 3.1.3 Class II
- 3.2 Electrical thermopots shall have the degree of protection against harmful ingress of water at least of protected against spraying water (IPX3) complying with TIS 513.

### 4. Requirements

- 4.1 Protection against accessibility to live parts
  - 4.1.1 Electrical thermopots shall be constructed and enclosed so that there are adequate protection against accidental contact with live parts.

*Note : An accessible part is not considered to be live if the part is separated from live parts by protective impedance, the current between the part and the supply source shall not exceed 2 mA for d.c. and its peak value shall not exceed 0.7 mA for a.c. and moreover for voltage having a peak value over 42.4 V up to and including 450 V the capacitance shall not exceed 0.1  $\mu$ F.*

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 8.1.4.
  - 4.1.2 Electrical thermopots Class II shall be constructed and enclosed so that there is adequate protection against accidental contact with basic insulation and metal parts separated from live parts by basic insulation only. It shall be only be possible to touch with are separated from live parts by double insulation or reinforced insulation.

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 8.2.
- 4.2 Power input and current

The power input of the appliance at rated voltage and at normal operating temperature shall not deviate from the rated power input by more than the deviation shown in table 1.

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 10.1.

**Table 1 : Power input deviation for electrical thermopots**  
(Clause 4.2.1)

Rated power input of electrical thermopots W	Deviation
$\leq 200$	$\pm 10\%$
$> 200$	$\pm 5\%$ or 20 W (whichever is the greater) – 10%

#### 4.3 Heating

Electrical thermopots and their surroundings shall not attain excessive temperatures in normal use.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 11, with the following addition:*

4.3.1 On testing in accordance with TIS 1375 Part 1, Clause 11.2 with the following addition.

Electrical thermopots are placed away from the walls of the test corner.

4.3.2 On testing in accordance with TIS 1375 Part 1, Clause 11.4 with the following addition.

In the case of motors transformer or electric circuit of electrical thermopots having temperature rise of motor, transformer or electric circuit exceeds the rated value and the rated power input less than rated power input range, the test being consecutively at 1.06 times the rated voltage range.

4.3.3 On testing in accordance with TIS 1375 Part 1, Clause 11.6 with the following addition.

Electrical thermopots incorporating a motor shall be tested in line with electrical thermopots not having motor.

4.3.4 The test is made in accordance with this following in stead of TIS 1375 Part 1, Clause 11.7.

The test shall be finished at the following conditions:

- Electrical thermopots not having thermostat, the test shall finish at 15 minute after the temperature reach to 95°C or maximum temperature which Electrical thermopots could be kept the temperature if maximum value less than 95°C.
- Electrical thermopots incorporating a thermostat, the test shall finish at 15 minute, after first cycle of thermostat.
- Electrical thermopots contact which give the heating, in order to warm the water, shall be operated until the temperature is stable.

4.3.5 On testing in accordance with TIS 1375 Part 1, Clause 11.8 with the following addition.

In the case of Electrical thermopots used connection which include thermostat pins is not considered to be such temperature limit. The temperature rise limits of motor, transformer and electronic circuit component and directly effect elements may be increased exceed the values limited when electrical thermopots operated at 1.15 times the rated power input.

4.4 Leakage current and electric strength at operating temperature.

At operating temperature, the leakage current shall not exceed 0.5 mA for class OI, 0.75 mA for class I and 0.5 mA for class II.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 13.*

4.5 Moisture resistance

4.5.1 The enclosure of electrical thermopots shall provide the degree of protection against moisture in accordance with the classification of the appliance.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 15.1.*

Immediately after the appropriate treatment, electrical thermopots shall withstand the electric strength test specified in 4.6 and inspection shall show that there is no trace of water or insulation which could result in a reduction of creepage distances and clearances below the values specified in Clause 4.18.1.

4.5.2 Electrical thermopots subject to spillage of liquid in normal use shall be constructed so that such spillage does not affect their electrical insulation, and shall withstand the electric strength test specified in Clause 4.6.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 15.2 with the following addition.*

Electrical thermopots provided with an appliance inlet are tested with an appropriate connector in position.

In the case of doubt, the test is made by spillage of liquid when electrical thermopots tilt from normal use position not exceeding 5°.

- 4.5.3 Electrical thermopots shall be proof against humid conditions which may occur in normal use.

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 15.3.

Immediately after this treatment, the electrical thermopots withstand the test of Clause 4.6.

- 4.6 Leakage current and electric strength

The leakage current of the appliance shall not be excessive and its electric strength shall be adequate, the leakage current shall not exceed 0.5 mA for class OI, 0.75 mA for class I and 0.25 mA for class II.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 16.3.*

- 4.7 Overload protection of transformers and associated circuits

Electrical thermopots incorporating circuits supplied from a transformer shall be constructed so that in the event of short circuits which are likely to occur in normal use, excessive temperatures do not occur in the transformer or in the circuits associated with the transformer.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 17.*

- 4.8 Abnormal operation

Electrical thermopots shall be constructed so that the following risks are kept to be at least:

Fire or mechanical change impairing safety or protection against electric shock as a result of abnormal or careless operation, is obviated as far as is practicable.

Electronic circuits shall be designed and applied so that a fault condition will not under the electrical thermopots unsafe with regard to electric shock, fire hazard or dangerous malfunction.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 19 with the following informations.*

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 19.2 with the following addition.*

Electrical thermopots shall be placed near to the test corner as possible; the test without water filling, whether open or close whichever occurs the dangerous first.

#### 4.9 Stability and mechanical hazards

4.9.1 Electrical thermopots shall have adequate stability.

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 20.1.

4.9.2 Moving parts of electrical thermopots, as far as is compatible with use and working of the electrical thermopots, be positioned or enclosed to provide adequate protection against personal injury in normal use.

Protective enclosure guards and similar parts shall be non-detachable parts and shall have adequate mechanical strength.

The unexpected reclosure of self-resetting thermal cut-outs and over-current protective devices shall not cause a hazard.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 20.2.*

#### 4.10 Mechanical strength

Electrical thermopots shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 21.*

#### 4.11 Construction

4.11.1 If the electrical thermopots is marked with protection against dust, degree of protection shall be in accordance with the level marked.

*Compliance is checked by the test specified in TIS 513.*

4.11.2 For stationary electrical thermopots, means shall be provided to ensure all pole disconnection from the supply. Such mean shall be one of the following:

- a supply cord fitted with a plug;
- a switch complying with 4.13.3
- a statement in the instruction sheet that a disconnection incorporated in the fixed wiring is to be provided;
- an appliance coupler.

If class I electrical thermopots with heating elements, which is intended to be permanently connected to fixed wiring, incorporated single-pole switches or single-pole protective

devices intended to disconnect the heating element from the supply, these shall be connected in the phase conductor.

*Compliance is checked by inspection.*

- 4.11.3 Electrical thermopots intended to be connected to the supply by means of a plug shall be constructed so that in normal use there is no risk of electric shock from charged capacitors when touching the pins of the plug.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.5.*

- 4.11.4 Appliances shall be constructed so that their electrical insulation cannot be affected by water which might condense on cold surfaces or by liquid which might leak from containers, hoses, couplings and similar parts of the appliance. Moreover, the electrical insulation of Class II appliances and Class II construction shall not be affected, if a hose ruptures or a seal leaks.

*Compliance is checked by inspection and by test specified in TIS 1375 Part 1, Clause 22.6 and with the following addition;*

Each water outlet hole shall have diameter not less than 5 mm or size not less than 20 mm<sup>2</sup> by not less than 3 mm in width.

- 4.11.5 For electrical thermopots having compartments to which access can be gained without the aid of a tool and which are likely to be cleaned in normal use, the electrical connections shall be arranged so that they are not subject to pulling during cleaning.

*Compliance is checked by inspection and by manual test.*

- 4.11.6 Reset buttons of non-self-resetting controls shall be located or protected so that their accidental resetting is unlikely to occur if this could result in a hazard.

*Compliance is checked by inspection.*

- 4.11.7 Non-detachable parts which provide the necessary degree of protection against electric shock, moisture or contact with moving parts, shall be fixed in a reliable manner and shall withstand the mechanical stress occurring in normal use.

Snap-in devices used for fixing such parts shall have an obvious locked position. The fixing properties of snap-in devices used in parts which are likely to be removed during installation or servicing shall not deteriorate.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.11*

- 4.11.8 Handles, knobs, grips, levers and similar parts shall be fixed in a reliable manner so that they will not work loose in normal use if loosening might result in hazard.

If handles, knobs and similar parts are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in a hazard.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.12*

- 4.11.9 Handles shall be constructed so that, when gripped as in normal use, contact between the operator's hand and parts having a temperature rise exceeding the value specified for handles which are held for short periods only in normal use, is unlikely.

*Compliance is checked by inspection and, if necessary, by test the temperature rises.*

**Table 2 : Maximum normal temperature rises**  
(Clause 4.11.9)

Part	Temperature rises K
Handles, knobs grips and similar parts which are continuously held in normal use for short periods only (e.g. switch)	
- of metal	35
- of porcelain or vitreous material	45
- of moulded material, rubber or wood	60

4.11.10 Electrical thermopots shall have no ragged or sharp edges, other than those necessary for the function of the appliance or accessory, that could create a hazard for the user in normal use or during user maintenance.

*Compliance is checked by inspection.*

4.11.11 Storage hook and the like for flexible cords (if any) shall be smooth and well-rounded.

*Compliance is checked by inspection.*

4.11.12 Automatic cord reels shall be constructed so that they cause

- no undue abrasion or damage to the sheath of the flexible cord;
- no breakage of conductor strands;
- no undue wear of contacts.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.16.*

4.11.13 Spacers intended to prevent the appliance from overheating walls shall be fixed so that it is not possible to remove them from the outside of the electrical by hand or by means of a screwdriver, a spanner or similar tools.

*Compliance is checked by inspection and by manual test.*

4.11.14 Current-carrying parts and other metal parts, the corrosion of which could result in a hazard, shall be resistant to corrosion under normal conditions of use.

*Compliance is checked by the test in TIS 1375 Part 1, Clause 22.18*

- 4.11.15 Direct contact between live parts and thermal insulation shall be effectively prevented, unless such material is non-corrosive, non-hygroscopic and non-combustible.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.20.*

*Notes : 1. Glass-wool is an example of thermal insulation which is satisfactory for the purpose of this requirement.*

*2. Non-impregnated slag-wool is an example of corrosive thermal insulation.*

- 4.11.16 Wood, cotton, silk, ordinary paper and similar fibrous or hygroscopic material shall not be used as insulation, unless impregnated.

*Compliance is checked by inspection.*

*Note : Insulating material is considered to be impregnated if the interstices between the fibres of the material are substantially filled with a suitable insulant.*

- 4.11.17 Asbestos shall not be used in the construction of electrical thermopots, unless the liberation of dust of impregnated asbestos or of asbestos fibres into the surrounding air is adequately prevented.

*Compliance is checked by inspection.*

- 4.11.18 Bare heating element shall be supported so that, if they rupture, the heating conductor is unlikely to come into contact with earthed metal parts or accessible metal parts.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.24*

- 4.11.19 Appliances other than class III shall be constructed so that sagging heating conductors cannot come into contact with accessible metal parts.

*Compliance is checked by inspection.*

- 4.11.20 Parts connected by protective impedance shall be separated by double insulation or reinforced insulation.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.27*

- 4.11.21 Class II electrical thermopots intended to be permanently connected to fixed wiring shall be constructed so that the required

degree of protection against electric shock is maintained after installation of the appliance.

*Compliance is checked by inspection.*

4.11.22 Parts of class II construction which serve as supplementary insulation or reinforced installation and which could be omitted during reassembly after servicing shall

(1) be fixed so that they cannot be removed without being seriously damaged, or

(2) be constructed so that they cannot be replaced in an incorrect position and so that if they are omitted, the appliance is rendered inoperable or manifestly incomplete.

*Compliance is checked by inspection and by manual test.*

*Note : Servicing includes replacement of components such as supply cords and switches.*

4.11.23 Creepage distances and clearances over supplementary insulation and reinforced insulation shall not be reduced below the values specified 4.18.1 as a result of wear. If any wire, screw, nut, washer, spring or similar part becomes loose or falls out of position, creepage distances and clearances over supplementary insulation or reinforced insulation shall not be reduced to less than 50% of the value specified in 4.18.1

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.31*

4.11.24 Supplementary insulation and reinforced insulation shall be designed or protected so that the deposition of dirt or the dust resulting from wear of part with in the appliance dose not reduce creepage distances or clearances below the values specified in 4.18.1

Ceramic material which is not tightly sintered, similar materials or beads alone shall not be used as supplementary insulation or reinforced insulation.

Past of natural or synthetic rubber used as supplementary insulation shall be resistant to ageing or be arranged and dimensioned so that creepage distances are not reduced below the values specified in 4.18.1 even if cracks occur.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.32.*

4.11.25 Conductive liquids which are or may become accessible in normal use shall not be in direct contact with live parts.

*Compliance is checked by inspection.*

4.11.26 Shafts of operating knobs, handles, levers and similar parts shall not be live unless the shaft is not accessible when the part is removed.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.34.*

4.11.27 For constructions other than those of class III, handles, levers and knobs which are held or actuated in normal use shall not become live in the event of an insulation fault. If these handles, levers or knobs are of metal and if their shafts or fixings are likely to become live in the event of an insulation fault, they shall either be adequately covered by insulating material or their accessible parts shall be separated from their shafts or fixings by supplementary insulation.

*Note : The insulation material is considered to be adequate if it complies with the test in TIS 1375 Part 1, Clause 16.3, table 5, item 4, complying with TIS 1375 Part 1, Clause 22.35*

4.11.28 For appliances other than those of Class III, handles which are continuously held in the hand in normal use shall be constructed so that when gripped as in normal use, the operator's hand is not likely to touch metal parts unless they are separated from live parts by double insulation or reinforced insulation.

*Compliance is checked by inspection.*

4.11.29 For Class II appliances, capacitors shall not be connected to accessible metal parts and their casings, if of metal, shall be separated from accessible metal parts by supplementary insulation.

This requirement does not apply to capacitor complying with the requirement for protective Impedance specified in 4.11.38.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 22.37.*

4.11.30 Capacitors shall not be connected between the contacts of a thermal cut-out.

*Compliance is checked by inspection.*

4.11.31 Lampholders shall be used Only for the connection of lamps.

*Compliance is checked by inspection.*

- 4.11.32 Mercury switches shall be mounted so that the mercury capsule cannot fall out of position or be damaged by the clamping means and they shall be arranged so that, should the capsule break, liquid or vaporous mercury cannot be released so as to contaminate the surroundings.

*Compliance is checked by inspection.*

- 4.11.33 Protective impedance shall consist of at least two separate components whose impedance is unlikely to change significantly during the lifetime of the appliance. If any one of the components is short-circuited or open-circuited the values specified in 4.1.1 shall not be exceeded.

*Compliance is checked by inspection and by measurement.*

*Note : Resistors complying with Clause 14.1 and capacitors complying with Clause 14.2 of TIS 1195 are considered to be appropriate components.*

- 4.11.34 Electrical thermopots which can be adjusted for different voltages shall be constructed so that accidental changing of the setting is unlikely to occur.

*Compliance is checked by manual test.*

- 4.11.35 Electrical thermopots shall be constructed so that do not overflowing or splashing of hot oil, which might result in a hazard to user when user operated by the user manual.

*Compliance is checked by inspection during the test of 4.3*

#### 4.12 Internal wiring

- 4.12.1 Wire ways shall be smooth and free from sharp edges.

Wires shall be protected so that they do not come into contact with burrs, cooling fins similar edges which may cause damage to their insulation.

Holes in metal through which insulated wires pass shall have smooth well-round surfaces or be provided with bushings.

Wiring shall be effectively prevented from coming into contact with moving parts.

Compliance is checked by inspection

- 4.12.2 Beads and similar ceramic insulators on live wires shall be fixed or supported so that they cannot change their position; they shall not rest on sharp edges or sharp corners. If beads are inside

flexible metal conduits, they shall be contained within an insulating sleeve, unless the conduit cannot move in normal use.

*Compliance is checked by inspection and by manual test.*

- 4.12.3 Different parts of an appliance which can move in normal use or during user maintenance relative to each other, shall not cause undue stress to electrical connections and internal conductors, including those providing earthing continuity. Flexible metallic tubes shall not cause damage to the insulation of the conductors contained within them.

Open-coil springs shall not be used to protect conductors. If a coiled spring, the turns of which touch one another, is used for this purpose, an adequate insulating lining shall be provided in addition to the insulation of the conductors.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 23.3*

- 4.12.4 Bare internal wiring shall be rigid and fixed so that, in normal use, creepage distances and clearances cannot be reduced below the values specified in 4.18.1

*Compliance is checked by inspection, by measurement and by manual test.*

- 4.12.5 The insulation of internal wiring shall withstand the electrical stress likely to occur in normal use.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 23.5*

- 4.12.6 When sleeving is used as supplementary insulation on internal wiring it shall be retained in position by positive means.

*Compliance is checked by inspection and by manual test.*

**Note :** *A sleeve is considered to be fixed by positive means if it can only be removed by breaking or cutting or if it is clamped at both ends.*

- 4.12.7 Conductors identified by the colour combination green/yellow shall only be used for earthing conductors.

*Compliance is checked by inspection.*

- 4.12.8 Aluminium wire shall not be used for internal wiring.

Compliance is checked by inspection.

**Note :** *Windings of a motor are not considered as internal wiring.*

- 4.12.9 Stranded conductors shall not be consolidated by lead - tin soldering where they are subjected to contact pressure, unless the

clamping means is constructed so that there is no risk of bad contact due to cold flow of the solder.

*Compliance is checked by inspection.*

**Note :** 1. *The requirements may be by using spring terminals.*

*Securing screws alone is not considered adequate.*

2. *Soldering of the tip of a stranded conductor is allowed.*

#### 4.13 Components

Components shall comply with the safety requirements specified in the relevant standards as far as they reasonably apply.

*Compliance is checked by inspection and by the tests of TIS 1375 Part 1, Clause 24.1.1 to 24.1.5.*

4.13.1 Appliance couplers incorporate thermostat, thermal Cut-Out or connection fuses shall comply with IEC 320 except that :

- accessible to earthing contacts is allowed but during insertion and removal of connectors, earthing contacts shall not be clamped ;
- the temperature required in Clause 4.7, specified temperature at the pins of inlet during the test of Clause 4.3
- breaking capacity test in IEC 320, Clause 19 shall be tested at appliance inlet.
- on testing in IEC 320, Clause 21 is not determined.

**Note :** *Thermostat incorporated in connectors in IEC 320 is not allowed.*

4.13.2 Electrical Thermostat shall not be fitted with:

- (1) switches or automatic controls in flexible cords.
- (2) devices which cause the protective device in the fixed wiring to operate in the event of a fault in the electrical thermopots.
- (3) thermal cut - outs which can be reset by a soldering operation.

*Compliance is checked by inspection and by measurement.*

4.13.3 Switches intended to ensure all-pole disconnection of stationary appliances, as required in 4.11.2, shall be directly connected to the supply terminals and shall have a contact separation of at least 3 mm in each pole.

*Compliance is checked by inspection and by measurement.*

4.14 Supply connection and external flexible cords

4.14.1 Electrical thermopots shall be provided with one of the following means for connection to the supply:

- supply cord fitted with a plug;
- an appliance inlet having at least the same degree of protection against moisture as required for electrical thermopots;
- pins for insertion into socket-outlets.

Electrical thermopots incorporating an appliance inlet other than those standardized in IEC 320, shall be supplied with a cord set.

*Compliance is checked by inspection.*

4.14.2 For appliances having a rated current not exceeding 16 A, cable and conduit entries shall be suitable for cables or conduit having a maximum overall diameter shown in table 3.

**Table 3 : Diameter of cables and conduits**

(Clause 4.14.2)

Number of conductors including earthing conductors	Maximum overall diameter mm	
	Cable	Conduit
2	13.0	16.0
3	14.0	16.0

Compliance is checked by inspection and by measurement.

4.14.3 Supply cord shall be assembled with the appliance by one of the following methods:

- (1) type X attachment ;
- (2) type Y attachment ;

*Compliance is checked by inspection.*

4.14.4 Plugs shall not be fitted with more than one flexible cord.

*Compliance is checked by inspection.*

4.14.5 Supply cord shall not be lighter than

- braided cord (code designation 245 IEC 51);
- ordinary tough rubber sheathed cord (code designation 245 IEC 53);
- light polyvinyl chloride cord (code designation 227 IEC 52), for appliances having a mass not exceeding 3 kg ;

- ordinary polyvinyl chloride sheathed cord (code designation 227 IEC 53) for appliances having a mass exceeding 3 kg, Polyvinyl chloride insulated cords shall not be used for appliances where the temperature rise of external metal part exceeds 75 K during the test of Clause 4.3. However they may be used if
  - the appliance is constructed so that the supply cord is not likely to touch such metal parts in normal use ;
  - the supply cord is appropriate for not higher temperatures. In this case, type Y attachment shall be used.

*Compliance is checked by inspection and by measurement.*

4.14.6 Conductors of supply cords shall have a nominal cross-sectional area not less than that shown in table 4.

*Compliance is checked by inspection.*

**Table 4: Minimum cross-sectional area of conductors**  
(Clause 4.14.6)

Rated current of appliances A	Nominal cross-sectional areas mm <sup>2</sup>
≤ 3	0.5*
> 3 and ≤ 6	0.75
> 6 and ≤ 10	1
> 10 and ≤ 16	1.5

*Note :* \*These cords may only be used if their length does not exceed 2 m.

4.14.7 Supply cords shall not be in contact with sharp points or edges of the appliance.

*Compliance is checked by inspection.*

4.14.8 The Supply cord of Class I appliances shall have a green/yellow core which is connected to the earthing terminal of the appliances and to earthing contact of the plug.

*Compliance is checked by inspection.*

4.14.9 Conductors of supply cords shall not be consolidated by lead-tin soldering where they are subject to contact pressure, unless the clamping means is constructed so that there is not risk of a bad contact due to cold flow of the solder.

*Compliance is checked by inspection.*

4.14.10 The insulation of the supply cord shall not be damaged when moulding the cord to part of the enclosure.

*Compliance is checked by inspection.*

4.14.11 Inlet openings shall be provided with a bushing or shall be constructed so that the sheath of the supply cord can be introduced without risk of damage.

*Compliance is checked by inspection and by manual test.*

4.14.11.1 Inlet bushings shall

- (1) be shaped to prevent damage to the supply cord;
- (2) not be detachable parts.

*Compliance is checked by inspection and by manual test.*

4.14.11.2 At inlet opening, the insulation the conductor of a supply cord and the enclosure of the electrical thermopots shall consist of the insulation of the conductor and in addition at least two separate insulations.

Only one separate insulation is required if the enclosure at the inlet opening is of insulation material.

The separate insulation shall consist of

- the sheath of a supply cord at least equivalent to that of that of a cord complying with TIS 11 or IEC 245, or
- a lining or bushing of insulation material complying with the requirements of 4.18.2 for supplementary insulation.

*Compliance is checked by inspection.*

4.14.12 Electrical thermopots provided with a supply cord shall have cord anchorages such that the conductors are relieved from strain, including twisting, where they are connected within the electrical thermopots and that the insulation of the conductors is protected from abrasion. The requirement also applies to electrical thermopots intended to be permanently connected to the fixed wiring by flexible cord.

It shall not be possible to push the cord into the electrical thermopots to such an extent that the cord or internal parts of the electrical thermopots could be damaged.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 25.15*

4.14.13 Cord anchorages for type X attachment shall be constructed and located so that

- replacement of the cord is easily possible;
- it is clear how the relief from strain and the prevention of twisting are obtained ;
- they are suitable for the different types of cord which may be connected, unless the cord is specially prepared ;
- the cord cannot touch the clamping screws of the cord anchorage if these screws are accessible, unless they are separated from accessible metal parts by supplementary insulation ;
- the cord is not clamped by metal screw which bears directly on the cord ;
- at least one part of the cord anchorage is securely fixed to the appliance unless it is part of a specially prepared cord ;
- screws which have to be operated when replacing the cord do not fix any other component. However this does not apply if
  - the screws are omitted or components are incorrectly positioned and the appliance becomes inoperative or is obviously incomplete;
  - the parts intended to be fastened by them cannot be removed without the aid of a tool during the replacement of the cord.
- for class I electrical thermopots, they are of insulating material or are provided with an insulating lining, unless a failure of the insulation of the cord does not make accessible metal parts live ;
- for class II electrical thermopots, they are of insulating material or if of metal, they are insulated from accessible metal parts by supplementary insulation.

**Notes** : 1. If the cord anchorage for type X attachment comprises one or clamping members to which pressure is applied by means of nuts engaging with studs which are securely attached to the appliance, the cord anchorage is considered to have one part

securely fixed to the appliance, even if the clamping member can be removed from the studs.

2. If the pressure on the clamping members is applied by means of one or more screws engaging with separate nuts or with a thread in a part which is integral with the appliance, the cord anchorage is not considered to have one part securely fixed to the appliance. This does not apply if one of the clamping members is fixed to the appliance is of insulating material and shaped so that it is obvious that the surface is one of the clamping members.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 25.16.*

- 4.14.14 For type Y attachment and type Z attachment, cord anchorages shall be adequate.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 25.15*

- 4.14.15 Cord anchorages shall be arranged so that they are only accessible with the aid of a tool or constructed so that the cord can only be fitted with the aid of a tool.

*Compliance is checked by inspection.*

- 4.14.16 For type X attachment, glands shall not be used as cord anchorages in portable appliances. Tying the cord into a knot or tying the cord with string is not allowed.

*Compliance is checked by inspection.*

- 4.14.17 The insulated conductors of the supply cord for type Y attachment shall be additionally insulated from accessible metal parts by basic insulation for (Class I electrical thermopots), and by supplementary insulation for class II electrical thermopots. This insulation may be provided by the sheath of the supply cord or by other means.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 25.20*

- 4.14.18 The space for connection of the supply cables for fixed wiring or for the connection of the supply cord provided for type X attachment shall be constructed.

- (1) to permit checking that the supply conductors are correctly positioned and connected before fitting any cover ;

- (2) so that any covers can be fitted without risk of damage to the conductors or their insulation;
- (3) for portable appliances, so that the uninsulated end of a conductor, should it become free from the terminal, cannot come into contact with accessible metal parts, unless the end of the cord is such that the conductors are unlikely are unlikely to slip free.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 25.21.*

#### 4.14.19 Appliance inlets shall

- (1) be located or enclosed so that live parts are not accessible during insertion or removal of connector ;
- (2) be located so that the connector can be inserted without difficulty;
- (3) be located so that, after insertion of the connector, the appliance is not supported by the connector when it is placed in any position of normal use on a flat surface ;
- (4) not be an appliance inlet for cold conditions if the temperature rise of external metal parts of the appliance exceeds 75 K during the test of Clause 11, unless the appliance is such that the supply cord is not likely to touch such metal parts in normal use.

*Compliance is checked by inspection.*

#### 4.15 Terminals for external conductors

4.15.1 Appliances with type X attachment and appliances for connections to fixed wiring shall be provide with terminal in which connection is made by means of screws, nuts or equally effective devices. This requirement dose not apply to appliances provided with supply leads or provided with a type X attachment having a specially prepared cord.

Screws and nuts shall not serve to fix any other component, except that they may also clamp internal conductors if these are arranged so that they are unlikely to be displaced when fitting the supply conductors.

*Compliance is checked by inspection.*

4.15.2 For electrical thermopots with type X attachment, soldered constructions may be used for the connection of external conductors, provided that the conductor is positioned or fixed so

that reliance is not placed upon the soldering alone to maintain the conductor in position. However soldering alone may be used if barriers are provided so that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50% of the values specified in 4.18.1 if the conductor becomes free at the soldered joint.

For appliances with type Y attachment, soldered, welded, crimped and similar connections may be used for the connection of external conductors. For Class II electrical thermopots, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering, crimping or welding alone to maintain the conductor in position. However soldering, welding or crimping alone may be used if barriers are provided so that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50 % of the values specified in 4.18.1 if the conductor becomes free at the soldered or welded joint or slips out of the crimped connection.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 26.1.2.*

- 4.15.3 Terminals for type X attachment and for connection to fixed wiring shall allow the connection of connectors having nominal cross – sectional areas shown in table 5. However if a specially prepared cord is used, the terminals need only be suitable for the connection of that cord.

*Compliance is checked by inspection, by measurement and by fitting cables or cord of the smallest and largest cross-sectional areas specified.*

**Table 5 – Nominal cross-sectional areas of conductors**

(Clause 4.15.3)

Rated current of tumbler dryers  A	Nominal cross-sectional areas mm <sup>2</sup>	
	Flexible cords	Cables for fixed wiring
≤ 3	0.5 and 0.75	1 and 2.5
> 3 and ≤ 6	0.75 and 1	1 and 2.5
> 6 and ≤ 10	1 and 1.5	1 and 2.5
> 10 and ≤ 16	1.5 and 2.5	1.5 and 4

4.15.4 Terminals for type X attachment and those for connection to fixed wiring shall be fixed so that when the clamping means is tightened or loosened

- the Terminals dose not loosened ;
- internal wiring is not subjected to stress ;
- creepage distances and clearances are not reduced below the values specified in 4.18.1

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 26.4.*

4.15.5 Terminals for type X attachment and those for connection to fixed wiring shall be constructed so that they clamp the conductor between metal surfaces with sufficient contact pressure and without damaging the conductor.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 26.5*

4.15.6 Terminals for type X attachment, except those with a specially prepared cord and those for connection to fixed wiring, shall not require preparation of the conductor. They shall be constructed or placed so that conductor cannot slip out when clamping screws or nuts are tightened.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 26.6*

4.15.7 Terminals of the pillar type shall be constructed and located so that the end of a conductor introduced into the hole is visible or

can pass beyond the threaded hold for a distance at least equal to half the nominal diameter of the screw or 2,5 mm, whichever is the greater.

*Compliance is checked by inspection and by measurement.*

- 4.15.8 Terminals, including the earthing terminal, for connection to fixed wiring shall be located close to each other.

*Compliance is checked by inspection.*

- 4.15.9 Terminals for type X attachment shall be accessible after removal of a cover or part of the enclosure.

*Compliance is checked by inspection.*

- 4.15.10 Terminals shall not be accessible without the aid of a tool, even if their live parts are not accessible.

*Compliance is checked by inspection and by manual test.*

- 4.15.11 Terminals for type X attachment shall be located or shielded so that if a wire of a stranded conductor escapes when the conductors are fitted, there is no risk of accidental connection between live parts and accessible metal parts and for Class II construction, between live parts and separated from accessible metal parts by supplementary insulation only.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 26.11*

#### 4.16 Provision for earthing

- 4.16.1 Accessible metal parts of Class 0I and Class I electrical thermopots which may become live in the event of an insulation fault, shall be permanently and reliably connected to an earthing terminal within the appliance or to the earthing contact of the appliance inlet.

Earthing terminal and earthing contact shall not be connected to the neutral terminal.

Class II electrical thermopots shall have no provision for earthing.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 27.1.*

- 4.16.2 Terminal with screw clamping shall comply with the relevant requirements of Clause 26. Screwless terminals shall comply with TIS 902, Appendix B.

Terminals for the connection of external equipotential bonding conductors shall allow the connection of conductors having nominal cross – sectional areas of 2,5 mm<sup>2</sup> to 6 mm<sup>2</sup> and shall not

be used to provide earthing continuity between different parts of the electrical thermopots. It shall not be possible to loosen the conductors without the aid of a tool.

The clamping means of earthing terminals shall be adequately secured against accidental loosening.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 27.2.*

- 4.16.3 If a detachable part is plugged into another part of the electrical thermopots and has an earth connection, this shall be made before the current-carrying connections are established when placing the part in position and the current-carrying connections shall be separated before the earth connection is broken when removing the part.

For appliance with supply cords, the arrangement of the terminals or the length of the conductors between the cord anchorage and the terminal, shall be such that the current-carrying conductors become taut before the earthing conductor if the cord slips out of the cord anchorage.

*Compliance is checked by the test inspection and by manual test.*

- 4.16.4 All parts of the earthing terminal intended for the connection of external conductors shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor or any other metal in contact with these parts.

Parts providing earthing continuity, other than parts of a metal frame or enclosure shall be of coated or uncoated metal having adequate resistance to corrosion. If such parts are of steel, they shall be provided at the essential areas with an electroplated coating having a thickness of at least 5  $\mu\text{m}$ .

Parts of coated or uncoated steel which are only intended to provide or to transmit contact pressure shall be adequately protected against rusting.

If the body of the earthing terminal is a part of a frame or enclosure of aluminium or aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys .

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 27.4.*

4.16.5 The connection between the earthing terminal or earthing contact and earthed metal parts shall have low resistance.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 27.5.*

#### 4.17 Screws and connections

4.17.1 Fixings, the failure of which may impair compliance with this standard and electrical connections shall withstand the mechanical stresses occurring in normal use.

Screws used for these purposes shall not be of metal which is soft or liable to creep, such as zinc or aluminium. If they are of insulating material they shall have a nominal diameter of at least 3 mm and they shall not be used for any electrical connection.

Screws transmitting electrical contact pressure shall screw into metal.

The following screws shall not be of insulating material:

- (1) Screws of which if metal screw are used instead could impair the supplementary insulating or reinforced insulation.
- (2) Screws which may be removed when replacing a supply cord having a type X attachment or when undertaking user maintenance shall not be of insulating material if their replacement by a metal screw could impair basic insulation.

*Note: Electrical connection include earthing connections.*

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 28.1.*

4.17.2 Electrical connections shall be constructed so that contact pressure is not transmitted through insulating material which is liable to shrink or to distort unless there is sufficient resiliency in the metallic part to compensate for any possible shrinkage or distortion of the insulating material.

*Note : Ceramic material is not liable to shrink or to distort.*

*Compliance is checked by the test inspection.*

4.17.3 Space-threaded (sheet metal) screw shall not be used for the connection of current-carrying parts, unless they clamp these directly in contact with each other.

Thread-cutting (self-tapping) screws shall not be used for the electrical connection of current-carrying parts, unless they generate a full form standard machine screw thread. Such screw

shall not be used if they are likely to be operated by the user or installer unless the thread is formed by a swaging action.

Thread-cutting space-threaded screws may be used to provide earthing continuity, provided that it is not necessary to disturb the connection in normal use and that at least two screws are used for each connection.

*Compliance is checked by the test inspection.*

- 4.17.4 Screws and nuts which make a mechanical between connection between different parts of the appliance shall be secured against loosening if they also make electrical connections or provide earthing continuity.

Rivets used for electrical connections shall be secured against loosening if these connections are subject to torsion in normal use.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 28.4.*

#### 4.18 Creepage distances, clearances and distances through insulation

- 4.18.1 Creepage distances and clearances shall not be less than the values in millimetres shown in table 6.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 29.1.*

**Table 6 : Minimum creepage distances and clearances**

(Clause 4.18.1)

Distance	Creepage distances	clearances
Between live parts of different potential <sup>1)</sup> - if protected against deposition of dirt <sup>2)</sup> - if not protected against deposition of dirt - if lacquered or enamelled windings - for positive temperature coefficient (PTC) resistors including their connecting wires, if protected against deposition of moisture or dirt <sup>2)</sup>	2.0 3.0 2.0 1.0	2.0 2.5 2.0 1.0
Between live parts and other metal parts over basic insulation: <sup>2)</sup> - if protected against deposition of dirt if of ceramic, pure mica and similar material if of other material - if not protected against deposition of dirt - if the live parts are lacquered or enamelled windings - at the end of tubular sheathed type heating electrical	2.5 <sup>3)</sup> 3.0 4.0 2.0 1.0 <sup>5)</sup>	2.5 <sup>3)</sup> 2.5 <sup>3)</sup> 3.0 2.0 1.0 <sup>4)</sup>
Between live parts and other metal parts over reinforced insulation : - if the live parts are lacquered or enamelled windings - for other live parts	6.0 8.0	6.0 8.0
Between metal parts separated by supplementary insulation	4.0	4.0
Between live parts in recesses in the mounting face of the appliance and the surface to which it is fixed	6.0	6.0

- Notes :*
- 1) *The clearances specified do not apply to the air gap between the contacts of automatic controls, switches of micro-gap construction and similar devices or to the air gap between the current-carrying members of such devices where the clearance varies with the movement of the contacts.*
  - 2) *In general, the interior of an appliance having a reasonably dust - proof enclosure is considered to be protected against deposition of dirt, provided the appliance does not generate dust within itself ; hermetic sealing is not required.*
  - 3) *If the parts are rigid and located by mouldings or if the construction is such that there is no likelihood of the distance being reduced by distortion or movement of the parts. This value may be reduced to 2,0 mm.*
  - 4) *If protected against deposition of dirt.*
  - 5) *If over ceramic, pure mica and similar materials, protected against deposition of dirt.*

4.18.2 The distance through between metal parts for working voltages up to and including 250 V shall not be less than 1.0 mm if they are separated by supplementary insulation and not be less than 2.0 mm if they are separated by reinforced insulation.

- Notes :*
1. *This does not imply that the distance has to be through solid insulation only. The insulation may consist of solid material plus one or more air layers.*
  2. *For appliances having parts with double insulation where there is no metal between basic insulation and supplementary insulation, the measurements are made as though there is a metal foil between the two insulations.*

4.18.2.1 This requirement does not apply if the insulation is applied in thin sheet form, other than mica or similar scaly material and

- (1) for supplementary insulation, consist of at least two layers, provided that each of the layers withstands the electric strength test of 4.5 for supplementary insulation;
- (2) for reinforced insulation, consist of at least three layers, provided that any two layers withstands the electric strength test of 4.5 for reinforced insulation.

4.18.2.2 This requirement also dose not apply if the supplementary insulation or the reinforced insulation is inaccessible and meets one of the following conditions :

- the maximum temperature rise determined during the tests of Clause 4.7 dose exceed the value specified in 4.3 ;
- the insulation, after having been conditioned 168 h in an oven maintained at a requirement equal to 50 K in excess of the maximum temperature rise determined during the tests of Clause 4.7, withstands the electric strength test of 4.5, this test being made on the insulation both at the temperature occurring in the oven and after cooling to approximately room temperature.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 29.2.*

#### 4.19 Resistance to heat, fire and tracking

4.19.1 The following parts, the deterioration of which might cause the electrical thermopots to fail to comply with the standard, shall be sufficiently resistance to heat.

- (1) External parts of non-material
- (2) Parts of insulating material supporting live parts insulating connecting, and
- (3) Parts of thermoplastic material providing supplementary insulators or reinforced insulations.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 30.1.*

4.19.2 Parts of non-metallic material shall be resistant to ignition and spread of fire. This requirement does not apply to decorative trims, knobs and other parts not likely to be ignited to propagate flames originating from inside the electrical thermopots.

Compliance is checked by the test specified in TIS 1375 Part 1, Clause 30.2, with the exception of 30.2.2

#### 4.20 Resistance to rusting

Ferrous parts, the rusting of which might cause the electrical thermopots to fail to comply with this standard, shall be adequately protected against rusting.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 31.*

4.21 Radiation, toxicity and similar hazards.

Electrical thermopots shall not be emit harmful radiation or present a toxic or similar hazard.

*Compliance is checked by the test specified in TIS 1375 Part 1, Clause 32.*

## 5. Marking and Labelling

5.1 On each Electrical thermopots shall at least numbers, letters or marking to indicate the following which shall be legible, clear and indelible.

- (1) Rated voltage or rated voltage range in volts or V.
- (2) Symbol for nature of supply (~ or a.c) or rated frequency in Hertz or HZ.
- (3) Rated power input in watts or W.
- (4) Rated current in amperes or A.
- (5) Model or type reference.
- (6) Symbol  for class II electrical thermopots only.
- (7) Symbol for degree of protection against ingress of water (sec Clause 3.2)
- (8) Maximum rated capacity in litres.
- (9) Name of manufacture or factory or registered trade mark.
- (10) Country of manufacture

5.2 Electrical thermopots shall have water level scale, additional marking of indicating the lower and upper level of water which electrical thermopots can be operated in normal use.

5.3 Terminals intended exclusively for the neutral connection shall be indicated by the letter N, intended exclusively for the potential conductor shall be indicated by the letter L and protective earthing Terminals shall be indicated by the symbol 

5.4 Switches which may give rise to a hazard when operated shall be marked or placed so as to indicate clearly which part of the electrical thermopots they control.

5.5 The instructions or manual for use of electrical thermopots shall be appropriate legible and read, and at least of the following informations :

- (1) The instructions for control devices.
- (2) The instructions for safety.
- (3) The instructions for installation and maintenance.

- 5.6 In case foreign language is used, the meaning shall correspond to that of Thai specified Clause.

## **6. Sampling and criteria for conformity**

- 6.1 Lot electrical thermopotss of the same type and classification, having the model, same rated power, and manufacturing or delivering or purchasing at the same period of time.
- 6.2 Sampling and criteria for conformity shall comply with the sampling plan specified below or with other technically equivalent plan.
- 6.2.1 Sampling  
One sample shall be drawn at random from a lot.
- 6.2.2 Criteria for conformity  
Provided the sample meets all the requirements of Clause 4 and 5, that lot of electrical thermopots shall be deems to comply with this standard.
-